REMARKS

Claim Rejections under 35 U.S.C. § 101

Claims 48-59 were rejected under 35 U.S.C. § 101 because they recite a mathematical algorithm per se without a required practical application. Applicants respectfully disagree.

Argument 1: Claim 48 is a new and useful "manufacture"

Independent claim 48 is directed to a computer-readable medium comprising a data storage device and computer-executable program code stored on the data storage device. Thus, claim 48 is directed to a new and useful "manufacture" under 35 U.S.C. § 101, not a "process" that solves a mathematical problem or manipulates abstract ideas or concepts.

Argument 2: Claim 48 is a patentable "process"

To the extent claim 48 is directed to a "process," it is directed to a patent-eligible "process" under 35 U.S.C. § 101. A process is directed to patent-eligible subject matter where it transforms raw data representing physical and tangible objects into a particular visual depiction of a physical object on a display. The claimed process need not require any transformation of the underlying physical object that the data represents. Claim 48 transforms raw data representing physical and tangible objects into a particular visual depiction of a physical object on a display by generating an image from ultrasound data. Therefore, claim 48 is directed to patent-eligible subject matter.

The New Test

On October 30, 2008, the United States Court of Appeals for the Federal Circuit ("CAFC") clarified the test for determining whether a claimed process is directed to patent-eligible subject matter. A process is patent-eligible if either (1) the claim is tied to a particular machine or apparatus, or (2) the claim transforms a particular article into a different state or thing. *In re Bilski*, 545 F.3d 943, 954, 88 U.S.P.Q.2d 1385, 1391, (Fed. Cir. 2008). This "machine-or-transformation" test replaces the "useful, concrete, and tangible result" inquiry. *Id.* at 959-60, 88 U.S.P.Q.2d at 1395.

However, the CAFC cited to a case from its predecessor court, the United States Court of Customs and Patent Appeal ("CCPA"), for even further clarification on the "transformation" prong. The CCPA had rejected an independent method claim as

directed to non-statutory subject matter, but reached the opposite conclusion for one of its dependent claims. *In re Abele*, 684 F.2d 902, 908, 214 U.S.P.Q. 682, 687 (C.C.P.A. 1982). The dependent claim recited:

> 6. The method of claim 5 wherein said data is X-ray attenuation data produced in a two dimensional field by a computed tomography scanner.[1]

Id. The CAFC clarified the CCPA's result by holding that the transformation of raw data representing physical and tangible objects into a particular visual depiction of a physical object on a display is sufficient to render a claimed process patent-eligible. *Bilski*, at 963, 88 U.S.P.Q.2d at 1397. Furthermore, "the electronic transformation of the data itself into a visual depiction in *Abele* was sufficient; the claim was not required to involve any transformation of the underlying physical object that the data represented." *Id.*

<u>Applying the New Test to Claims 48-59</u>

Claim 48 meets the *Bilski/Abele* test because it transforms raw pulses representing physical and tangible objects into a visual depiction of a physical object on a display. It does this by generating an image from ultrasound data.

The claim recites:

> 48. A computer-readable medium for generating a combined ultrasound image with a first imaging mode and a second imaging mode, the computer-readable medium comprising a data storage device and computer-executable program code stored on the data storage device, where the computer-executable program code operates on a computer and comprises:
>
> (a) code for generating transmit pulses at a predetermined voltage level for the first imaging mode;
>
> (b) code for acquiring a first image in the first imaging mode in response to the transmit pulses generated by the code in (a);
>
> (c) code for generating transmit pulses at the predetermined voltage level for the second imaging mode, with a duty cycle selected in response to one or more of: a restriction on surface temperature of a transducer, and a restriction on transducer power output;
>
> (d) code for acquiring a second image in the second imaging mode in response to the transmit pulses generated by the code in (c); and
>
> (e) code for displaying the first and second images.

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[1] *Abele* claim 5, which the Court held as directed to non-statutory subject matter, recited:

> 5. A method of displaying data in a field comprising the steps of:
>
> calculating the difference between the local value of the data at a data point in the field which surrounds said point for each point in said field, and
>
> displaying the value of said difference as a signed grey scale at a point in a picture which corresponds to said data point.

Similar to the X-ray attenuation data feature from *Abele*, claim 1 acquires and displays ultrasound images from transmitted pulses. In other words, it transforms data from ultrasound pulses representing physical and tangible objects into a visual depiction. *See*, *Bilski*, at 962-63, 88 U.S.P.Q.2d at 1397 (including as physical and tangible objects "the structure of bones, organs, and other body tissues"). According to *Bilski*, this transformation of electronic ultrasound data into an image is sufficient to be a patent-eligible process.

Applicants respectfully request withdrawal of the rejection and allowance of claims 48-59.

Claim Rejections under 35 U.S.C. § 103(a)

In the Office Action mailed December 10, 2008, claims 1-59 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent App. Pub. No. 2003/0236460 A1 ("Ma") in view of U.S. 6,669,638 B1 ("Miller").

Applicants respectfully request reconsideration of the rejections of pending claims 1-59, including independent claims 1, 28, 39, 46, and 48.

Independent **claims 1 and 48** recite, *inter alia*, generating transmit pulses at a predetermined voltage level for the first imaging mode; and generating transmit pulses at the predetermined voltage level for the second imaging mode, with a duty cycle selected in response to one or more of: a restriction on surface temperature of a transducer, and a restriction on transducer power output.

Ma does not disclose these features. Ma teaches reducing elevation fold-in artifacts by combining Doppler and B-mode image signals using a modulated, non-linear function (abstract). Ma is silent regarding voltage levels for acquiring the Doppler and B-mode image signals, let alone any predetermined voltage levels. Specifically, Ma does not teach or suggest generating transmit pulses at *the* predetermined voltage level for the second imaging mode, where the predetermined voltage level is also a predetermined voltage level for the first imaging mode.

The Office Action filed 12/10/2008 relies on Ma to suggest, not to teach, this feature (page 3, paragraph 4: "[t]he use of a single predetermined voltage value in repetition would have clearly been an obvious modification [of Ma] to one of ordinary

skill in the art."). The Office Action filed 12/10/2008 implicitly acknowledges that the "predetermined voltage" feature is not expressly taught by Ma, instead relying on an inherency argument (page 2, paragraph 5: "Examiner… holds that all signals have some kind of a "predetermined voltage" level associated with them.").

However, the use of a single predetermined voltage value between two ultrasound imaging modes is not an obvious modification of Ma. The various ultrasound imaging modes generally have different voltage requirements because the different modes typically use different pulse profiles for the ultrasound power being transmitted into the body (present specification, paras. [0008]-[0009]). For example, B-mode imaging may use a short-duration or single-cycle burst, while color-mode imaging may use a long-duration series of several cycles (present specification, para. [0010]). As a result, the B-mode burst may be operated at a higher voltage than the color-mode burst to optimize the image quality while keeping both bursts within safe limits on their total energy (Id.). Therefore, because different imaging modes used different voltage levels to optimize image quality while keeping bursts within safe limits on their total energy, it would not be obvious to modify Ma to reach the invention as claimed.

Furthermore, the Applicants of the present application recognize that the advantage of using a single predetermined voltage value between two ultrasound imaging modes "may provide a significant savings in cost or design complexity" (present specification, para. [0050]).

The Office Action filed 12/10/2008 states that Miller is not relied upon to teach generating transmit pulses at *the* predetermined voltage level for the second imaging mode, where the predetermined voltage level is also a predetermined voltage level for the first imaging mode (page 3, paragraph 3: "[Miller] was not used in order to teach that both imaging modes are using the same predetermined voltage."). Therefore, neither Ma, Miller, nor the combination of Ma and Miller teach or suggest generating transmit pulses at *the* predetermined voltage level for the second imaging mode, where the predetermined voltage level is also a predetermined voltage level for the first imaging mode.

Independent **claim 28** recites, *inter alia*, generating a first pulse train for a first mode of operation at a fixed voltage level selected in response to a restriction on

surface temperature of a transducer; and generating a second pulse train for a second mode of operation substantially at the fixed voltage level, wherein the second mode of operation is different from the first mode of operation.

Neither Ma, Miller, nor the combination of Ma and Miller discloses these features. Specifically, as argued above with respect to claim 1, Neither Ma, Miller, nor the combination of Ma and Miller teaches or suggests generating a second pulse train for a second mode of operation substantially at *the* fixed voltage level, where the fixed voltage level is also a fixed voltage level for the first mode of operation.

Independent **claim 39** recites, *inter alia*, a power supply coupled to the transducer and operable to supply a fixed voltage level to the transducer for both the first and second pulse trains; where the fixed voltage level is selected in response to one or more of: a restriction on surface temperature of the transducer, and a restriction on transducer power output.

Neither Ma, Miller, nor the combination of Ma and Miller discloses these features. Ma is silent regarding power supplies, let alone a power supply coupled to the transducer and operable to supply a fixed voltage level to the transducer for both the first and second pulse trains. Miller discloses a power supply, but not a power supply coupled to the transducer and operable to supply a fixed voltage level to the transducer for both the first and second pulse trains.

The use of a single power supply coupled to the transducer and operable to supply a fixed voltage level to the transducer for both the first and second pulse trains is not an obvious modification of Ma, Miller, or a combination of Ma and Miller. As discussed above with respect to claim 1, different imaging modes used different voltage levels to optimize image quality while keeping bursts within safe limits on their total energy. Furthermore, because the different imaging modes may operate with different levels of voltage while maintaining safety standards, duplex and triplex ultrasound systems use multiple voltage suppliers for the various imaging modes (present specification, para. [0011]). The switching between different voltage supplies allowed the system (1) to rapidly acquire images from the different modes, interleaving them into a smooth display for the benefit of a user, and (2) to operate in each mode with an optimal voltage supply that allows a maximum but safe voltage level for that imaging

mode (Id.). Therefore, because different voltage supplies allowed the system to rapidly acquire images from the different modes, interleaving them into a smooth display for the benefit of a user, and to operate in each mode with an optimal voltage supply that allows a maximum but safe voltage level for that imaging mode, it would not be obvious to modify Ma, Miller, or a combination of Ma and Miller to reach the invention as claimed.

Independent **claim 46** recites, *inter alia*, the number Nm of operating modes is greater than the number Np of fixed-voltage power sources.

Neither Ma, Miller, nor the combination of Ma and Miller teach or suggest these features. Ma is silent regarding power sources, fixed-voltage or otherwise.

Miller also does not disclose this feature. Miller teaches a power supply under control of a controller that controls the amount of power sent to an ultrasonic transducer (col. 8:10-13). Miller reduces a transmit voltage when a system is in a fundamental imaging mode and switches back to an original transmit voltage when the system is ready to be reset (col. 9:63 – 10:2; Fig. 6). However, Miller is silent regarding whether the power supply is a fixed-voltage power source. Both Ma and Miller are silent regarding fixed-voltage power sources. Therefore, neither Ma, Miller, nor the combination of Ma and Miller teach or suggest these features.

Dependent **claims 2-27, 29-38, 40-45, 47, and 49-59** each depend from one of the above independent claims and are allowable for at least the same reasons as their respective base claim. Further features patentably distinguish from Ma, Miller, and combinations thereof. Examples are provided below.

Claims 2 and 49 recite that generating transmit pulses at the predetermined voltage level for the first imaging mode comprises on-off switching of a single DC voltage supply. Miller teaches power circuits that stop providing power to an ultrasonic transducer, however, Miller goes on to say that these systems are inappropriate for ultrasonic imaging applications (col. 6:8-15).

Claims 4 and 50 recite that the second imaging mode is a Doppler-spectral ultrasound imaging mode. Ma and Miller teach Doppler color-flow imaging (Ma [0005]; Miller 4:32-40), however, Doppler color-flow imaging is not Doppler-*spectral* imaging (see, present specification, paras. [0004]-[0005]).

Claims 7-20, 26-27 and 54-55 recite specific values and/or ranges that are not disclosed or suggested in Ma, Miller, or a combination of Ma and Miller.

Claims 21-22, 33-34, 41, 47 and 56 recite unipolar and/or bipolar pulses that are not disclosed or suggested in Ma, Miller, or a combination of Ma and Miller.

Claims 23 and 57 recite using one or more switches to engage or disengage the voltage supply that are not disclosed or suggested in Ma, Miller, or a combination of Ma and Miller.

Claims 35-37 and 44-45 recite specific transmit cycles that are not disclosed or suggested in Ma, Miller, or a combination of Ma and Miller.

Claim 38 recites filtering the received pulse train with a lower center frequency than a center frequency of the transmit pulse train that is not disclosed or suggested in Ma, Miller, or a combination of Ma and Miller.

CONCLUSION

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof.

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Date: Jan. 30, 2009